D-3054 **EROSION CONTROL SYSTEM AND METHOD**

RELATED APPLICATION

This application claims the benefit of U.S. provisional application Serial No. 60/456,358 filed on March 21, 2003, the entire disclosure of which is incorporated herein by this reference.

BACKGROUND OF THE INVENTION

The present invention generally relates to erosion control systems, and more specifically relates to a system for controlling soil loss on a sloped surface.

Erosion control is an essential environmental consideration when new slope embankments are created, for example during construction of buildings and drainage systems. Traditionally, the development of root reinforcement systems are relied upon to control erosion. Methods have been developed for stabilizing soil on hillsides and embankments by encouraging the growth of native or introduced vegetation along the surface. Ideally, a mature root system within the sloped surface functions to bond together the hillside or other sloped surface and inhibits soil loss during rains and other stresses.

However, embankment surfaces often require reinforcement, particularly during the pre-vegetated stage and early stages of plant growth, to prevent loss of soil, seeds, seedlings and other small plants when the soil is in an unstable state.

Various reinforcement systems have been developed. For example, erosion control blankets are commercially available for moderate slope applications. Conventional erosion

control blankets are typically made of woven natural or synthetic fibers. These blankets are designed to form a porous, protective covering over a surface prone to erosion.

A well known problem associated with many conventional erosion control blankets and similar rolled erosion control products is soil migration which often occurs beneath the blanket, particularly within pockets and gaps which form if the matting does not closely conform to varying contours of the terrain. Thus, prior to installation, the sloped surface is often compacted and leveled. After installation, a common practice is to overfill the blanketed surface with granular material to provide further compaction. Installation of these blankets can be time consuming and, unfortunately, the success or failure of the installation will often not be made apparent until much time has passed.

Another common practice for controlling erosion on a sloped surface involves mechanical application of a mulching material to a soil surface to be stabilized. Mulching materials, for example straw fibers, are often blown onto a bare slope and mechanically incorporated into a loose soil surface by means of crimping techniques using heavy equipment.

Other methods of controlling erosion include bonded fiber matrix mixtures which are hydraulically sprayed onto a bare slope. These matrix mixtures typically provide only limited, short term erosion control protection. For example, these materials are typically utilized in cases where rapid germination and vegetation is more likely to occur. Problems encountered with this form of erosion control include breaking/fracturing of the bonded fiber matrix layer and lateral surface movement due to geo-technical instability or surface traffic. In addition, such

sprayed mixtures are limited to relatively low grade slopes and are not suitable for steep slope application due to their low tensile strength.

Jacobson, Jr. et al, U.S. Patent No. 5,330,828, discloses an erosion control matting made of a thermo-mechanically processed, blended mixture of wood fibers and synthetic fibers.

Lancaster, U.S. Pat. No. 5,849,645 discloses a reinforced composite matting formed of a coconut fiber matrix and a cuspated netting forming ridges and troughs extending across a width of the netting for capturing sediment.

Kimberlin et al., U.S. Patent Application No. 10/072,149, filed on February 2, 2002, teaches a highly effective erosion control matting system structured to resist trapping of sediment, for example during a hydraulic event, and protect soil, seeds and seedlings beneath the matting when the matting is fastened to a sloped surface.

West et al. U.S. Pat. No. 5,459,181 discloses a hydraulic binder composition for covering particulate materials, such as soil, for providing erosion control.

Spittle, U.S. Pat. No. 5,942,029 discloses a mechanically bonded fiber mulch including natural and crimped synthetic fibers blended with a polymer-based water absorbent powder.

The entire disclosure of each of the documents cited hereinabove is incorporated herein in its entirety by this reference.

There is still a need for better erosion control systems and methods. The present invention provides more effective, more technically advanced systems and methods for controlling soil loss erosion, for example on steeply sloped surfaces.

SUMMARY OF THE INVENTION

Accordingly, new erosion control systems and methods are provided, which generally comprise a flexible matting adapted to be secured to or placed on a sloped surface, for example a substantially non-vegetated surface.

In some embodiments of the invention, a method of stabilizing a surface is provided wherein the method generally comprising the steps of disposing a porous element, for example a synthetic cellular matting, onto a surface to be stabilized, for example a substantially unvegetated soil surface, depositing a flowable material onto the porous element, said flowable material entering openings defined within said porous element, and allowing the flowable material to set within said openings to thereby form a desirable microclimate between said matting and said surface, said microclimate being favorable to growth of vegetation.

Preferably, the step of depositing a flowable material is performed after the step of disposing the porous element on the surface to be stabilized.

For example, in accordance with the present invention, the porous element may be fixed to the sloped surface to be stabilized by installing the porous element to the sloped surface in accordance with conventional installation methods for erosion control matting. For example, the porous

element may comprise a rolled excelsior erosion control matting. The step of disposing the matting may therefor include unrolling the matting onto the surface, generally in the direction of water flow, and without causing any substantial stretching thereof, such that the matting will lie smoothly but loosely on the soil surface.

The matting may then be affixed to the surface by conventional means, for example, by means of staple fasteners, for example, U-shaped steel staples placed at spaced apart intervals along the matting.

Next, in accordance with the present invention, the flowable material is deposited onto the porous element. Suitable means for depositing the flowable material depend at least in part upon the type of flowable material selected. Preferably, the flowable material is a mulch matrix material that when applied in its flowable form, will at least partially enter openings or pores of the porous element and preferably, upon setting or solidifying, become affixed to surfaces of the porous element.

In some embodiments of the invention, the flowable material is sprayed onto the porous element using conventional mulching apparatus. In other embodiments of the invention, the flowable material is injected into the porous element. In a preferred embodiment of the invention, the flowable material is injected into the interstices, pores and openings of the porous element using conventional mechanical seeding apparatus.

The present invention also provides systems for stabilizing a surface prone to soil erosion. The present systems generally comprise a blanket element disposed on a surface to be stabilized, and a matrix material incorporated

within the blanket element. More specifically, the system is installed to the surface by anchoring the blanket element to the surface, applying a fluid matrix material to the blanket element, and thereafter allowing the fluid matrix material to enter and set within openings and cavities within in the blanket element.

Additional aspects and advantages of the present invention are set forth in the following description and claims, particularly when considered in conjunction with the accompanying drawings in which like parts bear like reference numerals.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 shows a cross-sectional diagrammatical view of an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Accordingly, a method for stabilizing a surface, for example a soil surface prone to erosion, is provided. The method is designed for long term, steep slope applications which conventionally have been problematic in terms of erosion control.

The method of the present invention generally comprises the steps of disposing a porous element, for example an erosion control blanket, on a surface to be stabilized, and depositing, for example by injecting, a flowable material onto the porous element. The flowable material enters openings, for example interstices, pores and/or cavities, defined within the porous element. The flowable material is allowed to set, e.g. cure or solidify, within said openings. Once the flowable material is set, the treated erosion

control blanket provides an exceptionally stable, desirable microclimate on the soil surface, maintains heat, allows ventilation of gasses, maintains moisture, and resists soil and seedling migration.

Preferably, the step of depositing a flowable material is performed only after the porous element has been placed, and preferably secured to, for example anchored to, the surface to be stabilized. Even more preferably, the step of depositing is performed by hydraulically applying the flowable material to the porous element, for example by means of conventional equipment. For example, the flowable material may be applied to the porous element disposed on the surface by means of sprayers, hydraulic blowers and/or other machinery that is conventionally used to apply mulching material or apply a bonded fiber matrix to a bare soil surface. In accordance with and especially advantageous embodiment of the invention, the flowable material is essentially injected into the porous element, for example using conventional agricultural seeding apparatus.

Once the flowable material is set or solidified within the porous element, the covering formed thereby restrains lateral movement of soil while retaining cohesiveness of the sloped surface. The covering maintains a healthy microclimate environment on the soil surface, for example the covering promotes a substantially consistent temperature and holds moisture.

Preferably, the porous element comprises a natural or synthetic permanent or temporary erosion control matting, typically supplied in a rolled form. For example, the porous element may comprise any a woven or non-woven blanket, matting or netting, or combinations thereof, for

example, a reinforced fiber blanket made of natural material, for example, straw, shredded wood, excelsior, coconut fibers and the like, or synthetic materials, for example polyester fibers, polypropylene fibers and the like. The porous element may comprise a relatively heavy, more permanent, three dimensional matting, or a relatively lightweight, substantially two dimensional netting made or natural or synthetic strands, ropes and the like. In some embodiments of the invention, the porous element comprises a plurality of layers of the same or different materials.

In a preferred embodiment suitable for long-term, or permanent application, the porous element comprises a synthetic, three dimensional cellular matting, for example having substantial open area, formed of cavities and pockets with which to hold the bonded fiber matrix or other flowable material in place. For example, the porous element may comprise 3-D Enkamat® manufactured by Colbond Geosynthetics.

In a preferred embodiment suitable for relatively short term, or temporary application, the porous element comprises a two dimensional polyester or polypropylene netting material. The netting may be photodegradable and/or biodegradable.

Preferably, the step of disposing comprises securing the porous element to the surface prior to the step of depositing the flowable material. The porous element may be secured by means of permanent or photodegradable/biodegradable staples, anchors or any other suitable means for holding the mat to the soil surface. Advantageously, it has been found that the present system and methods require relatively reduced anchoring requirements in comparison to utilizing a erosion control matting alone.

Preferably, the flowable material comprises a mulching material, more preferably a bonded fiber matrix mixture, for example a conventional bonded fiber matrix mixture. These matrix mixtures comprise fibers or other mulch material that is mixed as a slurry and upon application to a slope become bonded, for example by interlocking fibers or by a chemical reaction between ingredients of the mixture. Such bonded fiber matrix material are well known to those of skill in the art and are commercially available from a variety of sources.

In accordance with some embodiments of the present invention, the flowable material comprises a hydraulic mulch, for example a mulching material such as shredded wood, paper, or straw fibers, that is mixed with water, agitated in a holding tank, and then sprayed onto the porous material.

In a more preferred embodiment of the invention, the flowable material comprises a bonded matrix, a mechanically bonded water absorbent mulch, or other suitable material, for example, a bonded material made of natural and/or synthetic fibers mixed with a bonding material, such as a polymer. A suitable mechanically bonded mulch may comprise, for example, a mixture of up to about 90% or more of a fiber material mixed with a polymeric material or a polymeric material mixed with water. Other suitable flowable materials are disclosed for example in West et al., U.S. Pat. No. 5,459,181. the disclosure of which has been incorporated herein. The flowable material may comprise a material marketed under the name Hydro-Blanket® manufactured by Terra-Mulch. In other embodiments of the invention, the bonded fiber matrix comprises for example the bonded fiber matrix marketed under the name "Soil Guard" and manufactured by Mat, Inc., or another quality matrix material that will

not substantially rewet and cause loss of mechanical strength between the fibers.

In accordance with the present invention, the bonded fiber matrix material may be applied to the porous member, for example sprayed onto the porous member, with or without seeds and/or other additives first mixed or otherwise incorporated into the bonded fiber matrix mixture or slurry.

Turning now to Fig. 1, a system for stabilizing a surface prone to soil erosion in accordance with the present invention is shown generally at 10. The system generally comprises a porous element, for example, but not limited to a reinforced fibrous blanket 12, disposed on a surface 14 to be stabilized, and a matrix material 16 incorporated within the blanket element 12 wherein the system is made in accordance with the methods described elsewhere herein.

For example, the system 10 may be made by installing the blanket 12 to the surface 14, anchoring the blanket element 12 thereto, for example by means of staples 18, and thereafter hydraulically applying or injecting the matrix material 16 into the blanket 12 while the matrix material 16 is in a flowable form. The combination of blanket 12 and matrix material 16 is allowed to set and bond to internal and external surfaces of the blanket 12, providing an stable, ideal microclimate for plant growth and establishment.

While this invention has been described with respect to various specific examples and embodiments, it is to be understood that the invention is not limited thereto and that it can be variously practiced within the scope of the following claims.